

---

# Synthesis of highly dispersible and ultra pure graphene oxide

---

**Mukesh K.Kumawat\***, Rohit Srivastava

Department of Biosciences and Bioengineering, IIT Bombay, Mumbai, India-400076

\*[mukesh87.iitb@gmail.com](mailto:mukesh87.iitb@gmail.com)

Graphene oxide (GO) synthesis by oxidation of graphite was pioneered by Brodie<sup>1</sup> in 1859, its modification in 1898 by Staudenmaier<sup>2</sup>, thereafter Hummer's method<sup>3</sup> is most widely used method for synthesis of GO. Several modifications<sup>4-6</sup> of Hummer's method have been suggested in last decade. Here we report another modification wherein we chemically processed the graphite before it was used for Hummer's method to produce GO. The prepared GO was purified by washing several times using centrifugation. The term for synthesized GO is m-GO ('m' stands for modified) and GO synthesized by Hummer's method is h-GO. On comparison, m-GO with h-GO it was found that m-GO was highly dispersible and ultra pure (Figure 1). m-GO was characterized by TEM and AFM (Figure 2). TEM image (Figure 2A) showed residual carbon free pure graphene oxide sheets and SAED pattern was ordered. AFM image (Figure 2B) confirmed that m-GO sheets were well exfoliated and had thickness <1 nm. Comparison of UV-visible absorption spectra of equal concentration of m-GO and h-GO (Figure 3) revealed that m-GO had more  $\pi$ - $\pi^*$  transitions (higher  $\lambda_{max}$ ). High dispersibility and high purity of m-GO makes it suitable for synthesis of GO based composite materials and biological applications.

## References

---

- [1] Brodie et al, Philos.Trans. R. Soc. London, **14** (1859) 249–259.
- [2] Staudenmaier et al, Ber. Dtsch. Chem. Ges. **31** (1898) 1481–1487.
- [3] Hummers et al, J. Am. Chem. Soc. **80** (1958) 1339.
- [4] Wang et al, CARBON **47** (2009) 68–72.
- [5] Sun et al, Nano Res **1** (2008) 203-212.
- [6] Daniela et al, ACS Nano, **4**, 8 (2010) 4806–4814.

## Figures

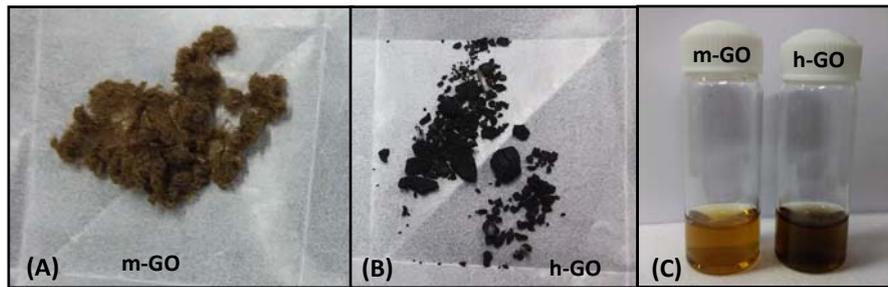


Figure 1: (A) and (B) Digital photographs of Solid m-GO (yellow brown) and h-GO (dark brown) respectively (C) Digital photograph of aqueous dispersions of m-GO and h-GO at 0.2mg/mL concentration.

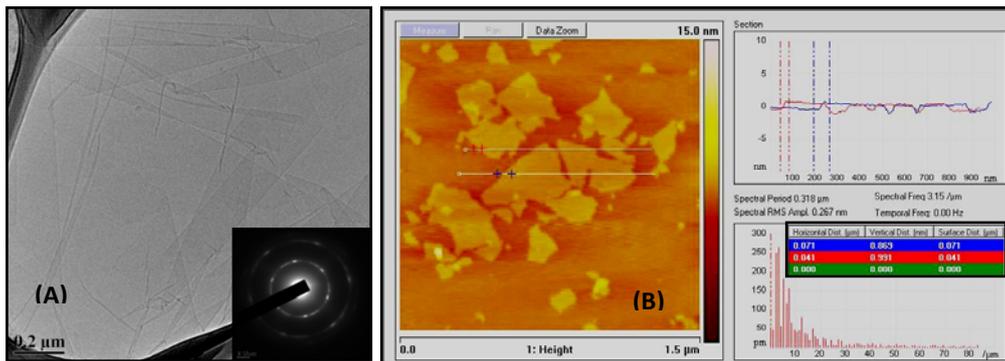


Figure 2: (A) TEM image of m-GO and its SAED pattern (inset). (B) AFM image of m-GO with its section analysis on right side displaying thickness of <1 nm.

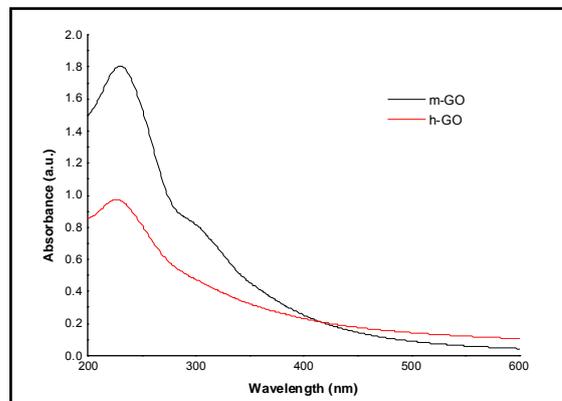


Figure: 3 Comparison of UV Visible spectra of m-GO and h-GO at concentration of 0.4 mg/mL.